An osteopathic approach to knee pain in athletes

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By

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Introduction

Sports Professionals in this era have a daunting task; to always be stronger, faster, and better. They are placed under a high amount of stress and pressure to always perform and be the best. If one ever wants to slow down and take a short break, his competitors will always overtake him and very soon, he will be out of the race. These are the demands an athlete goes through to be the best, to produce results, and to bring glory home. In order to achieve results, athletes place their bodies under a tremendous amount of physical stress. One slip and that's it, end of their sporting career. Old school training methodology may no longer be applicable to athletes nowadays. Sports professionals have to adopt a more structured regimen backed by sports science. They have to follow a comprehensive, systematic, and integrated system in order to achieve success. In this paper, I will put together why Sports Strength and Conditioning (SSC) is extremely essential for every individual sportsman/ and sportswomen and how therapy will complement it

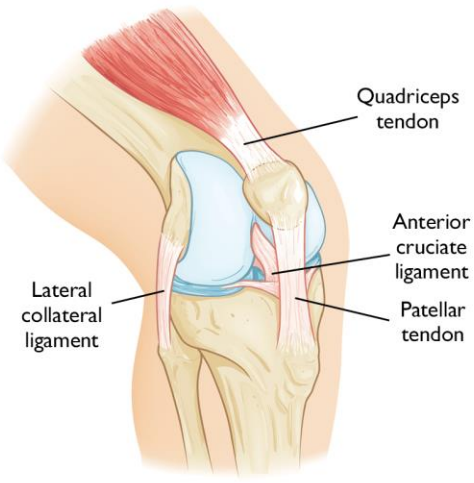
Osteopathy focuses on identifying the root cause of a complaint and providing treatment to restore the body to optimal function and movement patterns. Osteopathic practitioners take a detailed patient's history and assess symptoms by using palpation and physical evaluation tests in an attempt to determine the underlying condition and treat that condition accordingly. There are some instances, however, where a diagnosis can be a challenge and where conditions may overlap or contribute to one another. It is therefore important for an osteopath to understand differential diagnoses of a patient's complaint to fully understand the condition.

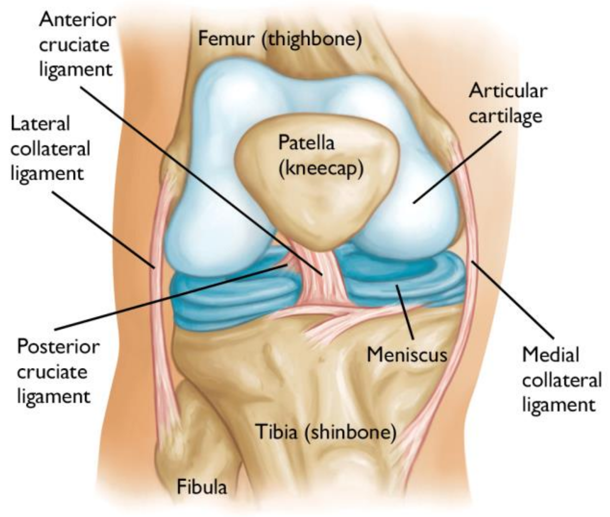
Pain is a complex, multifaceted perception that varies in strength, quality, duration, location, and unpleasantness. Research has enabled us to recognize that pain is better described as an experience influenced by many factors, and not simply or directly related to the nature and extent of tissue damage (McGrath, 1994). An osteopath understands that pain is subjective and thus treats holistically, tailoring the therapy to the individual's pain presentation. A pain scale is established with the patient upon initial meeting and is re-established after each treatment and with each visit.

Osteopathy in Sports Medicine Sports injuries are common

In particular, with contact sports activities where bruises and traces are section and parcel of day-to-day life. The nature of sports activities nowadays is so intense and frantic that accidents are nearly inevitable; to tackle this, osteopathy has emerged as a vital part of the condition process; for example, the range of sport clubs availing of an Osteopath has improved appreciably in recent years. Professional sports gamers depend on Osteopathic therapy as a means of maintaining their own bodies in top of the line physical form as well as a way to heal or ease current conditions. Common sports activities injuries consist of strains and sprains, which have an effect on the tendons, muscle mass and ligaments as well as swelling, bruising and areas of muscular pain or aching. (Sports Medicine Information,2009) What is Osteopathy? Osteopathy is a method of analysis and remedy in a broad variety of clinical conditions. It works with the shape and feature of the physique and is primarily based on the precept that the well- 3 being of a person relies upon on the skeleton, muscles, ligaments and connective tissues functioning fluently together. To an osteopath, for your physique to work well, it needs to work as a unit. So, Osteopaths work to fix your physique to its balance, without the use of pills or surgery. Osteopaths use touch, and musculoskeletal manipulations to enhance the mobility of joints, to relieve muscle tension, to increase the blood and nerve impulse to tissues, and to help your body's own recuperation mechanisms. They can also also grant recommendation on posture and workout to promote recovery, health and prevent signs and symptoms recurring. (General Osteopathic Council, 2020)

ANATOMY AND KINESIOLOGY OF THE KNEE





Functionally, the knee comprises 2 articulations-the patellofemoral and tibiofemoral. The stability of the joint is governed by a combination of static ligaments, dynamic muscular forces, meniscocapsular aponeurosis, bony topography, and joint load

The knee is the largest joint in the body, and one of the most easily injured. It is made up of four main structures: bones, cartilage, ligaments, and tendons.

- Bones. Two bones meet to form your knee joint: the thighbone (femur) and the shinbone (tibia). The kneecap (patella) sits in front of the joint to provide some protection.
- Articular cartilage. The ends of the femur and tibia, and the back of the patella are covered with articular cartilage. This slippery substance helps your knee bones glide smoothly across each other as you bend or straighten your leg.
- Meniscus. Two wedge-shaped pieces of meniscal cartilage act as shock absorbers between your femur and tibia. Different from articular cartilage, the meniscus is tough and rubbery to help cushion and stabilize the joint. When people talk about torn cartilage in the knee, they are usually referring to a torn meniscus.
- Ligaments. Bones are connected to other bones by ligaments. The four main ligaments in your knee act like strong ropes to hold the bones together and keep your knee stable.
    - Collateral ligaments. These are found on the sides of your knee. The medial collateral ligament is on the inside of your knee, and the lateral collateral ligament is on the outside. They control the side-to-side motion of your knee.
    - Cruciate ligaments. These are found inside your knee joint. They cross each other to form an X with the anterior cruciate ligament in front and the posterior cruciate ligament in back. The cruciate ligaments control the front and back motion of your knee.

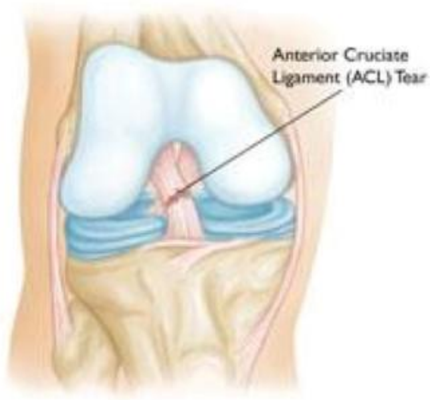
- Tendons. Muscles are connected to bones by tendons. The quadriceps tendon connects the muscles in the front of the thigh to the patella. The patellar tendon, on the other hand, runs from the patella to the tibia.

Common Knee Injuries

The most common knee injuries include sprains and tears of soft tissues (e.g., ligaments, meniscus), fractures, and dislocation. In many cases, injuries involve more than one structure in the knee.

Pain and swelling are the most common signs of knee injury. In addition, the knee may catch or lock. Some knee injuries (e.g., ACL tear) cause instability — the feeling that your knee is giving way.

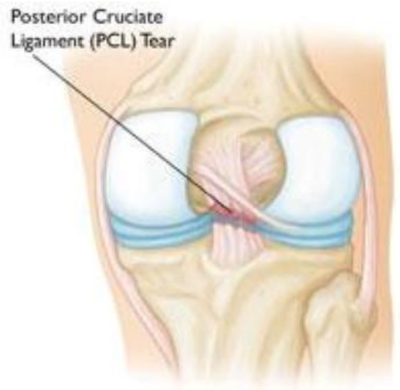
Anterior Cruciate Ligament (ACL) Injuries



The anterior cruciate ligament is often injured during sports activities. ACL injuries are more likely to occur in athletes who participate in cutting and pivoting sports like soccer, football, and basketball. Changing direction rapidly or landing from a jump incorrectly can tear the ACL.

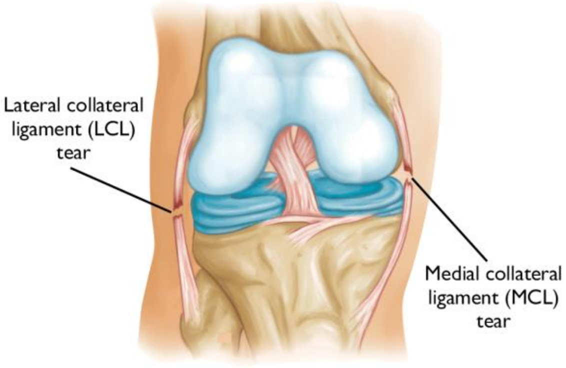
About half of all injuries to the anterior cruciate ligament occur along with damage to other structures in the knee, such as articular cartilage, meniscus, or other ligaments.

Posterior Cruciate Ligament (PCL) Injuries



The posterior cruciate ligament is often injured from a blow to the front of the knee, while the knee is bent. This often occurs in motor vehicle crashes and sports-related contact. Posterior cruciate ligament tears tend to be partial tears with the potential to heal on their own.

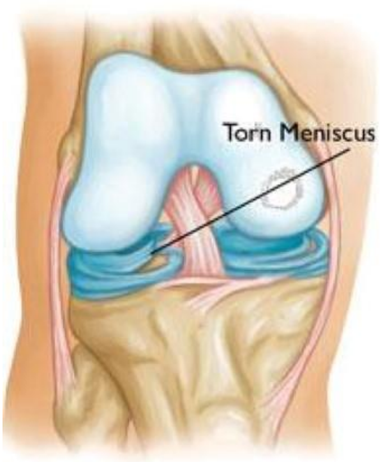
Collateral Ligament Injuries



Injuries to the collateral ligaments are usually caused by a force that pushes the knee sideways. These often contact injuries.

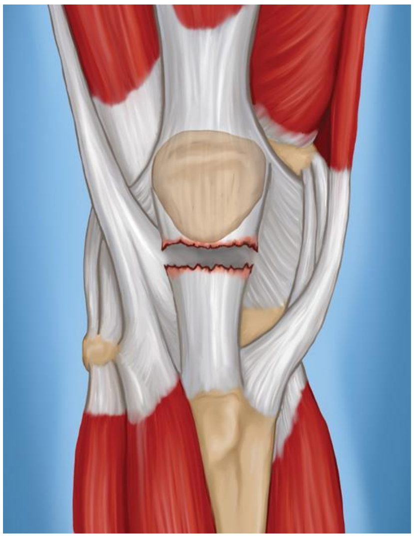
- Injuries to the MCL are usually caused by a direct blow to the outside of the knee and are often sports-related.
- Blows to the inside of the knee that pushes the knee outwards may injure the lateral collateral ligament (LCL). Lateral collateral ligament tears occur less frequently than other knee injuries.

Meniscal Tears



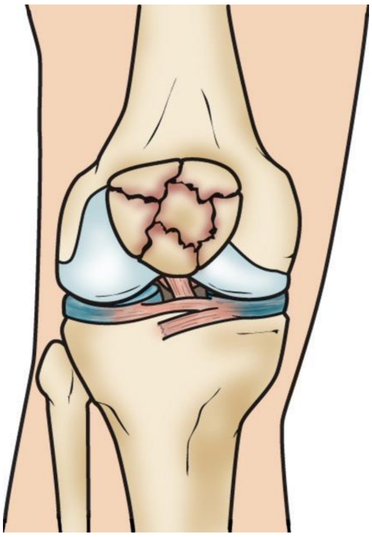
- Acute meniscal tears often happen during sports. Tears in the meniscus can occur when twisting, cutting, pivoting, or being tackled.
- Meniscal tears may also occur as a result of arthritis or aging. Even an awkward twist when getting up from a chair may be enough to cause a tear if the menisci have weakened with age.

Tendon Tears



The quadriceps and patellar tendons can be stretched and torn. Although anyone can injure these tendons, tears are more common among middle-aged people who play running or jumping sports. Falls, direct force to the front of the knee, and landing awkwardly from a jump are common causes of knee tendon injuries.

Fractures



The most common bone broken around the knee is the patella. The ends of the femur and tibia where they meet to form the knee joint can also be fractured. Many fractures around the knee are caused by high energy trauma, such as falls from significant heights and motor vehicle collisions.

Dislocation

A dislocation occurs when the bones of the knee are out of place, either completely or partially. For example, the femur and tibia can be forced out of alignment, and the patella can also slip out of place.

- Dislocations can be caused by an abnormality in the structure of a person's knee.
- In people who have normal knee structure, dislocations are most often caused by high energy trauma, such as falls, motor vehicle crashes, and sports-related contact.

Case Report

(From previous study)

History of Chief Complaint

A 26-year-old white woman presented with right lateral knee pain. Current symptoms began 1.5 years previously after being treated surgically with a medial-patellofemoral reconstruction with allograft and tibial tubercle osteotomy to correct chronic patella subluxation. Physical therapy rehabilitation with proprioceptive therapy, stretching, and mild strengthening exercises was provided for 6 months. Following 6 months of postoperative physical therapy, an MRI was normal, showing a healed tibial ostomy with realignment of patellar tendon, and she was released from surgical care. Unfortunately, the patient continued to have constant lateral knee pain, self-rated as 2-3/10 on the pain scale.

The pain does not radiate and is located on the right inferolateral patella. After running, the pain is sharper and slightly increased, and after prolonged sitting, the pain is a dull, throbbing sensation. The patient admits to numbness of right shin, which has been constant since the surgery. She denies muscle weakness, tingling, and low back pain. She has tried stretching before and after exercise, which seems to help a little. Her surgeon and physical therapists had no other suggestions besides NSAIDs, ice, and rest. She tried 800 mg ibuprofen as needed after exercise, which helped reduce the pain slightly.

History

The patient denies any current medical problems. Patient admits to a chronic history of knee subluxation since 8 years of age, which was treated surgically by medial-patellofemoral reconstruction with allograft and tibial tubercle osteotomy on the right knee in 2014. The patient’s mother had no known medical problems. The patient’s father had cervical spinal fusion in his 40s. The patient reported drinking one cup of coffee per day and drinking alcohol once per week. She denies smoking and illicit drug use. The patient had no known drug allergies, and she was taking 800 mg of ibuprofen every 6 hours as required for knee pain.

Physical Exam

Patient was a 26-year-old woman in no acute distress (blood pressure: 118/68 mmHg; heart rate: 70 beats per minute; respiration rate: 16 breaths per minute; height: 5'4"; weight: 135 lbs). No abnormalities were noted upon examination of ear, nose and throat; cardiac; respiratory; or vascular systems. The patient was alert and oriented to person, place, and time with pleasant affect. A neurologic exam reveals cranial nerves II-XII were grossly intact, and deep tendon reflexes were 2/4 in upper and lower extremities bilaterally. Muscle strength was 5/5 in upper and lower extremities bilaterally, negative straight leg raise bilaterally. No gait abnormalities were appreciated. An osteopathic structural examination revealed right patellar counterstrain point at the 8 o'clock position, right posterior fibular head, right externally rotated tibia, and restriction of right first metatarsal. Patient had a left-on-left sacrum, right anterior innominate, and L2 flexed, rotated and The hamstring and quadricep muscle groups showed no restrictions or tightness. Assessment Lateral knee pain was secondary to IT band friction syndrome, and there were somatic dysfunctions of the rib, lumbar, sacrum, pelvis, and lower extremity.side bent left. Left psoas was tighter than the right psoas. There was a right quadratus lumborum counterstrain point and there was tightness of the right IT band noted. In addition, bilateral respiratory diaphragm restriction was noted.

Plan

Osteopathic manipulation treatment (OMT) was performed on the somatic dysfunctions. A percussion hammer was used to correct the sacral dysfunction. Muscle energy along with the percussion hammer was used on the L2 somatic dysfunction. Muscle energy was also used to correct the anterior innominate rotation and psoas hypertonicity. A combination of muscle energy and articulatory techniques was used for the right posterior fibula. Additional articulatory techniques were used for the metatarsal dysfunction. Myofascial release was used on both the IT band and bilateral diaphragm dysfunctions. Lastly, counterstrain was used on the quadratus lumborum and patellar tenderpoints. A posttreatment exam demonstrated resolution of the somatic dysfunctions listed above. There was also immediate resolution of the patient's knee pain. The patient was instructed on how to perform counterstrain to address her patellar pain, should it reoccur. In addition, proper stretching of IT band and psoas muscle was taught. The patient was scheduled to follow up in 1 week, at which time the patient reported no reoccurrence of her knee pain. At a 2-year follow-up, the patient reported little to no reoccurrences of the lateral knee pain. She continued to stretch her IT band and psoas 4 to 5 times a week after exercise. She has also increased her physical activities to include water skiing, wakeboarding, and hiking.

Discussion

ITBFS is the result of repetitive friction between the IT band and lateral femoral condyle, which causes tightening of the IT band and diffuse lateral knee pain. The IT band originates from the iliac crests and subsequently divides into a central and anterior component. The central component, or iliotibial track, continues down the femur, passes over the greater trochanter and vastus lateralis, terminating at the infra-condylar tubercle of the tibia.The anterior component, known as the iliopatellar band, has been found to insert on the transverse and longitudinal retinaculum of the patella, contributing to the patella's stability. Consequently, the IT band has attachment sites at the femur, patella, and tibia. A tight IT band can place additional lateral strain on the knee, producing diffuse lateral knee pain.

ITBFS is a common cause of lateral knee pain in athletes, especially in runners, which can be explained by the motion of the IT band itself. Repetitive flexion and extension of the knee causes the IT band to move anteriorly and posteriorly, respectively, at the lateral femoral condyle resulting in inflammation. This friction peaks at approximately 30º of knee flexion, which occurs just after foot strike in runners.2,8 Prolonged friction, such as excessive running or running downhill, has been thought to result in the development of ITBFS. A tight IT band increases friction at the lateral femoral condyle, leading to increased inflammation and lateral knee pain. The IT band surrounds the tensor fascia lata (TFL) and assists in anchoring the TFL to the iliac crest. Contraction of the TFL tightens the IT band and contributes to hip flexion. Unbalanced contraction of the TFL and IT band can result in an anterior rotation of the innominate, as seen in this case. Park et al demonstrated that an externally rotated tibia pulls the patella laterally as the IT band load increases. Also, increased tension from the IT band has been known to cause external rotation of the tibia and lateral tilt of the patella, which can be explained by the anatomical attachments mentioned above. It has been previously recommended to treat the tibial rotation, to aid in IT band flexibility and patellar maltracking. This patient had an externally rotated tibia and a tight IT band, which was treated and aided in the resolution of her lateral knee pain. This lends support to Park et al's recommendation of treating the tibial rotation in addition to IT band stretching. The patient in this case had a posterior fibular head and a lateral patellar tenderpoint. The popliteofibular ligament originates from the musculotendinous junction of the patellar tendon and inserts on the fibular styloid process16; therefore, it is reasonable to conclude that a posterior fibular head can place additional lateral strain on the patellar tendon. Consequently, fibular dysfunctions, in addition to an externally rotated tibia and tight IT band, can result in an increased lateral pull on the connecting patellar fascia, resulting in the formation of a patellar tenderpoint and potential maltracking, as demonstrated in this case. ITBFS is known to cause lateral knee pain, patellar maltracking, and patellofemoral pain syndrome.This patient was noted to have a history of both lateral knee pain and patellar maltracking. Using OMT to correct these dysfunctions significantly reduced the lateral pull on the patellar fascia, resolving the lateral knee pain.

Conclusion

Future patients with a history of lateral knee pain caused by ITBFS could benefit from OMT. This recommendation is based on the anatomical connections described above. Using osteopathic manipulative medicine (OMM) to treat the lower extremity dysfunctions in this patient reduced the lateral tension on the patella, resolving the lateral knee pain. Proper stretching of the IT band can be easily taught to patients, who can then perform the exercises at home as needed. This stretching in combination with OMT can be used as adjunctive therapy in the management of lateral knee pain caused by ITBFS.

Special tests for diagnosis of knee pain

Special Tests for Diagnosis of Knee Pain

Test	Method or Appearance	Pictures	Significance
Varus-Valgus Stress Test	Abduction/adduction motion to the proximal tibia with knee extended and flexed	 	Laxity at 30 degrees = Injury to the MCL (valgus) or LCL (varus) Laxity at 0 degrees = Injury to the MCL/LCL and PCL
Lachman Test (most sensitive)	30 degrees of flexion, one hand on tibia and other on thigh, articulate tibia anteriorly		Positive test = anterior translation of the tibia on the femur = ACL injury
Pivot Shift Test	Knee in extension. Internally rotate tibia and place valgus stress on knee		
Anterior Drawer Test	90 degrees of flexion. Translate tibia anteriorly		
Posterior Drawer Test	90 degrees of flexion. Translate tibia posteriorly		Positive test = posterior translation of the tibia = PCL injury
McMurray's Test	Monitor joint line, flex knee, internally rotate tibia and apply a varus stress while extending the knee, or externally rotate tibia and apply a valgus stress while extending the knee		Palpable click or pop and pain = medial or lateral meniscal injury
Apley's Compression Test	90 degrees of flexion, press on heel down while internally/externally rotating foot		Joint pain = medial or lateral meniscal injury
External Rotation - Recurvatum Test	Lift patient's leg by great toe while stabilizing distal thigh, 10 degrees of flexion, release calf to allow full extension		Knee hyperextended and tibia externally rotated = injury to the posterolateral corner (PCL) - fibular collateral ligament, arcuate ligament and the popliteus
Knee Joint Effusion Test (Bounce Home Test)			Knee unable to fully extend = abnormal amount of joint fluid
Patellofemoral Grind Test	Knee extended, push patella inferiorly, tell patient to contract quadriceps muscles		Increased patellar motion, pain or crepitus = Deterioration of the cartilage under the patella (possibly) patellar chondromalacia)
Thessaly Test	Patient on one leg, holding onto examiners hands for balance, patient flexes knees to 20 degrees and rotates femur on tibia medially and laterally while maintaining flexion		Medial or lateral joint line discomfort, or a sense of locking or catching of the knee = meniscus tear

Osteopathic manual therapy (OMT) of knee pain

OMT Treatments of Knee Pain

Technique	Region of Treatment	Clinical Findings	Diagnosis
Muscle Energy: Place bone or joint into barrier and apply isometric resistance against patient's active contraction of muscle for 3-5 sec; Repeat 3-5 times	Posterior Fibular Head	Foot inversion, forefoot adduction, tibial rotation	Symptoms of compression of peroneal nerve
	Anterior Fibular Head	Foot eversion, forefoot abduction, tibial external rotation	Lateral Knee Pain
	Tibiofemoral joint: Knee Extension /Flexion, Internal / External Rotation Somatic Dysfunction	Internal rotation of femur, external rotation of tibia (due to relaxation of popliteus)	OA, RA, Baker's Cyst
		External rotation of femur, internal rotation of tibia (due to contraction of popliteus)	
	Hip: anterior / posterior rotation, superior / inferior shear, inflare / outflare somatic dysfunction	Flexion / Extension	Extrinsic causes / Referred Pain (see Figure 2)
		Abduction / Adduction	
		Internal / External Rotation	
	Lumbar Spine	Type I SD	Neutral Group Curve
		Type II SD	Non-neutral Group Curve
Counterstrain: Position joint to shorten muscle until pain is relieved / "mobile point" is reached. Hold positioning for 90 seconds to allow for reduction in proprioceptive firing. Return joint slowly to neutral to prevent re-initiation of inappropriate firing	Anterior Patella	T.P - Patellar tendon	Patellofemoral pain syndrome
	Medial/Lateral Patella	T.P - Medial or lateral patellar surface	
	Posterior Knee	T.P - Medial or Lateral ACL	ACL/PCL injury; Gastrocnemius sprain; Popliteal (Baker's cyst); DVT
		T.P - Center of Popliteal Fossa	
		T.P - Lower popliteal fossa	
	Medial Knee	T.P - Medial Joint Line	Medial Meniscus injury, OA, pes anserine bursitis, medial plica syndrome, medial collateral ligament sprain, medial meniscal tear
		T.P - Medial hamstring muscle, distal attachment	
	Lateral Knee	T.P - Lateral joint line	Lateral meniscus injury, lateral compartment OA, lateral collateral ligament sprain, lateral meniscal injury, iliotibial band tendonitis
		T.P - Lateral hamstring, distal attachment, near fibular head	
FPR: Articulation is placed into freedoms. Compression is applied to shorten involved muscle. Joint is moved in direction of muscle being treated and hold until release	Tibiofemoral joint	Point tenderness at and medial to midpoint of knee joint	OA, pes anserine bursitis medial plica syndrome, medial collateral ligament sprain, medial meniscal tear
HVLA: Restricted joint placed into restrictive barrier(s). A small to moderate amount of force is applied to the joint in a way that moves it through its barriers	Anterior / Posterior Fibular Head	Lateral Knee Pain; if Posterior Fibular Head symptoms of peroneal nerve compression	Lateral Compartment OA, lateral collateral ligament sprain, lateral meniscal tear, iliotibial band tendonitis

FPR: Fascilitated Positional Release; HVLA- High Velocity Low Amplitude, T.P.- Tender point

Therapy for Athletes

Therapy for athletes is another important aspect of SSC and athletic therapy. Therapy is the prevention, immediate care, and rehabilitation of musculoskeletal injuries. A therapist will be able to assess an individual for any injury and also educate them in injury prevention. In terms of SSC, therapists play an integral role by applying various massage techniques to stretch the muscles, manipulate joints and loosen the tight ligaments. This allows an athlete to recover faster and stay injury-free in most cases. Massage helps to relieve both physical stress and mental stress and allows the athlete to catch a better night of sleep. Moreover, it is very evident that massage therapy works as all the top athletes in the world are engaging professional Osteopaths to help overcome their injuries and for injury prevention.

Components of an Integrated Sports Strength and Conditioning Program

As mentioned above, an integrated program means covering all aspects of conditioning in order to be functional. And performing at optimal or peak level during in season of Sport.

1. Flexibility Training
2. Cardiorespiratory Training
3. Core Training
4. Balance Training
5. Plyometric Training
6. Speed, Agility, and Quickness Training
7. Multiplanar Resistance Training
8. Sports Specific Conditioning

From its beginnings, osteopathic medicine has taken an active role in promoting participation in athletics as a means to a healthy lifestyle and providing specialized treatment to athletes

Osteopathic principles and practice, including the use of manual medicine, have a large role in the treatment of the athlete. Each athlete should be evaluated and treated on an individual basis, including a comprehensive evaluation of both structure and function when appropriate. Because of the wide variety of potential injuries and medical maladies that can affect the athlete, the sports medicine physician must be comprehensively trained. Finally, physicians must always keep the health of the athlete as their primary goal when considering return-to-play decisions

In conclusion, OMT is a particular treatment used by osteopathic physicians to complement conventional treatment of musculoskeletal disorders. There are many studies showings the value of manual therapy in treating knee pain and osteoarthritis. Besides, expert opinions support that osteopathic manipulative treatment of the knee is useful in relieving knee pain. Therefore, it is assumed that OMT would provide similar benefits to those derived from studies reviewing other manual therapies.

there is dogma that higher training load causes higher injury rates. However, there is also evidence that training has a protective effect against injury. For example, team sport athletes who performed more than 18 weeks of training before sustaining their initial injuries were at reduced risk of sustaining a subsequent injury, while high chronic workloads have been shown to decrease the risk of injury. Second, across a wide range of sports, well-developed physical qualities are associated with a reduced risk of injury. Clearly, for athletes to develop the physical capacities required to provide a protective effect against injury, they must be prepared to train hard. Finally, there is also evidence that *under-training* may increase injury risk. Collectively, these results emphasise that reductions in workloads may not always be the best approach to protect against injury.

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